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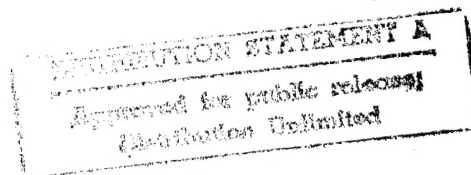
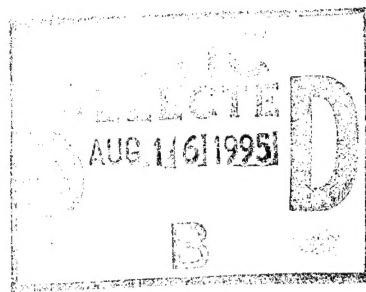
RME-2031(Pt. 1)

Subject Category: GEOLOGY AND MINERALOGY

UNITED STATES ATOMIC ENERGY COMMISSION

EXPLORATION DIAMOND DRILLING IN THE  
BOULDER BATHOLITH, JEFFERSON AND  
SILVER BOW COUNTIES, MONTANA

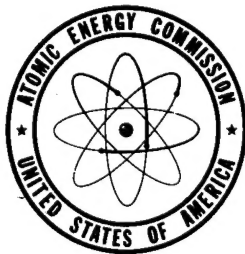
By  
L. D. Jarrard  
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March 1955

Salt Lake Exploration Branch  
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RME-2031-Part 1

UNITED STATES ATOMIC ENERGY COMMISSION  
DIVISION OF RAW MATERIALS  
SALT LAKE EXPLORATION BRANCH

EXPLORATION DIAMOND DRILLING IN THE BOULDER  
BATHOLITH, JEFFERSON AND SILVER BOW COUNTIES, MONTANA

by  
L. D. Jarrard and W. E. Mead

March 1955  
(Salt Lake City, Utah)

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BATHOLITH, JEFFERSON AND SILVER BOW COUNTIES, MONTANA

Table of Contents

	<u>Page</u>
ABSTRACT	5
INTRODUCTION	5
Location and Accessibility	5
Climate	7
Background of Uranium Development	7
GENERAL GEOLOGY	7
MINERAL DEPOSITS	8
DIAMOND DRILLING PROJECT	8
Areas Drilled and General Results	8
Base-Metal Types	9
A. Gray Eagle-Comet shear zone	9
B. Lone Eagle mine	9
C. Nickelodeon claim	10
D. Uncle Sam mine	10
Siliceous Reef Type Deposits	10
A. President group	10
B. Redstone-Atomizer claims	11
C. Red Rock claim	11
D. Mooney claim	11
Drilling Operations	12
Radiometric Logging	12
Sampling Procedure	12
BIBLIOGRAPHY	13

# EXPLORATION DIAMOND DRILLING IN THE BOULDER BATHOLITH, JEFFERSON AND SILVER BOW COUNTIES, MONTANA

## Part I

### ABSTRACT

The Boulder batholith region is located in southwestern Montana (Figure 1). Uranium was first discovered in the area in June 1949 and since then many new occurrences have been recognized, although few are of commercial importance.

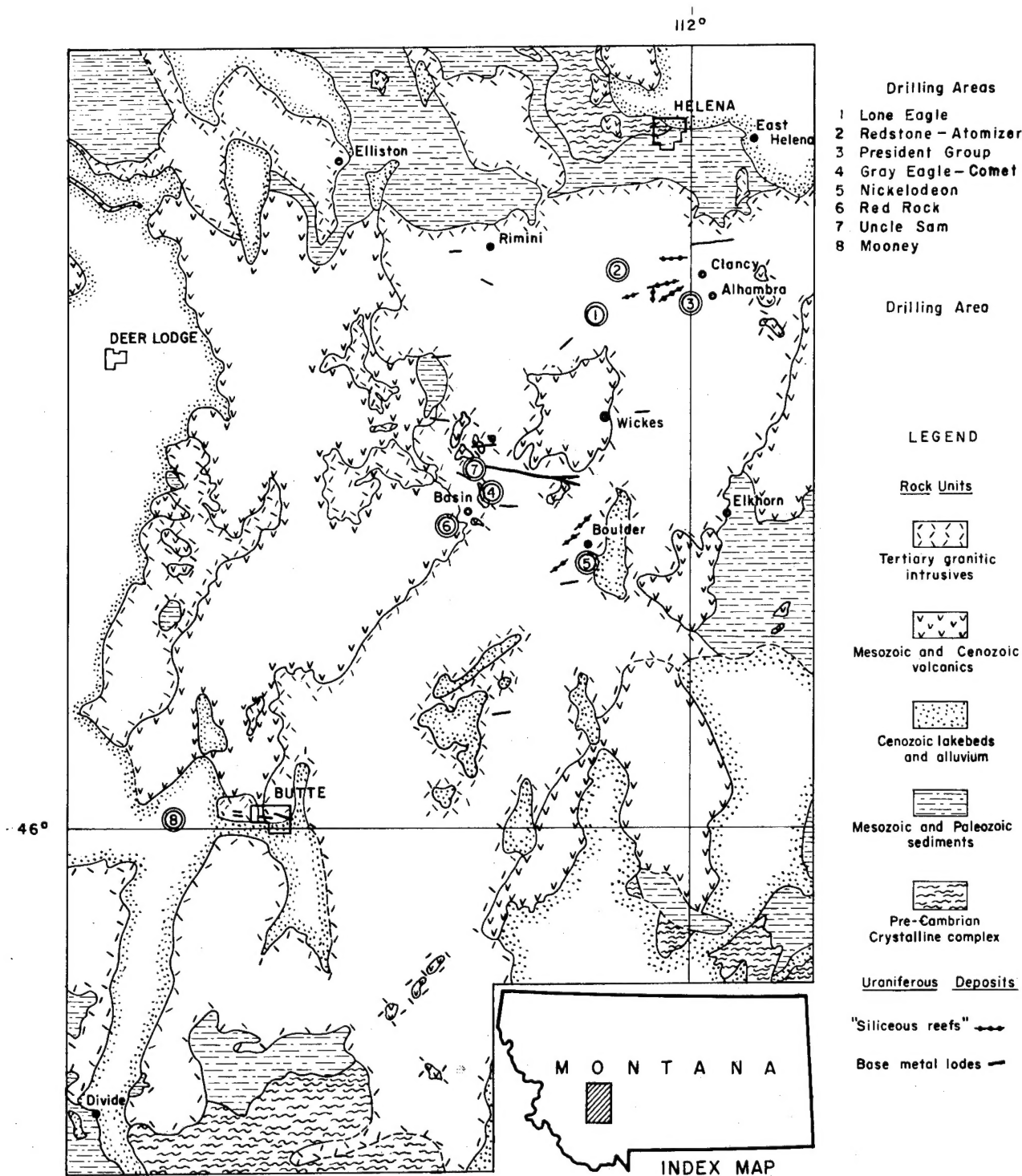
During the summer of 1953, the Commission sponsored its first diamond drilling program in the batholith to explore at depth a number of interesting uranium showings. Operations commenced in July 1953 and ended in November 1953, with the completion of 60 holes totaling 9,807.5 feet.

Radiometric logging of the drill holes was accomplished by means of a Geiger counter-type probe. Samples for chemical assay were selected after checking the core with a Geiger counter and correlation with the radiometric logging record. The exploration project did not disclose significant amounts of ore-grade material although encouraging indications were found at two different properties.

### INTRODUCTION

#### Location and Accessibility

The Boulder batholith is situated in the southwestern part of the state of Montana and extends from near the city of Butte northeastward as far as Helena; highway U. S. 91, the principal hard-surfaced road, crosses the central portion of the batholith. Two main gravel-surfaced roads cross the mountains and are joined by numerous dirt roads, which give access to much of the remote portions of the area. Steep, wooded, mountainous terrain interspersed among grassy rolling highlands is characteristic of the area. Elevations range from 4,000 to 9,000 feet above sea level.



## Climate

Summers are cool in the Boulder batholith region, but the winters are of long duration and accompanied by heavy snowfalls and below-freezing temperatures. A great portion of the area is virtually inaccessible from December to May or June. The climate is semi-arid.

## Background of Uranium Development

Uranium minerals were first recognized in the Boulder batholith in the spring of 1949 near the villages of Boulder and Clancy. One of these was the W. Wilson mine, now the principal producer of uranium in the batholith. Up to the present time there has been uranium production from three mines, the Free Enterprise, the W. Wilson, and the Lone Eagle. Only the latter two are now producing. Other occurrences show some promise for future production.

## GENERAL GEOLOGY

The Boulder batholith is a massive igneous intrusive approximating an hourglass in shape. It is about 60 miles long and attains a width of about 30 miles. The principal axis trends north-northeast. Flanking the batholith, which is probably of early Tertiary age, are late Paleozoic and Cretaceous sediments, Cretaceous volcanics, and Miocene-Pliocene continental deposits. Remnants of Tertiary flows cap portions of the batholith and roof pendants of pre-intrusive rocks, principally volcanics, are found within the igneous mass. The Boulder batholith consists of quartz monzonite with minor textural and compositional variations. The quartz monzonite intrudes earlier volcanic rocks and is in turn intruded by dikes and small plugs of dacite and andesite, as well as by dikes and sheet-like masses of alaskitic composition having aplitic, granitic, porphyritic, and pegmatitic textural facies. Many fractures and zones of brecciation accompanied by silicification exist in the rocks. Differential weathering of the silicified zones has left prominent topographic expressions known as "ribs" or "reefs". It is in association with these reefs that one type of uranium mineralization occurs.

## MINERAL DEPOSITS

The metallic mineral deposits of the Boulder batholith may be divided into two general types representing two different ages of mineralization. An earlier period resulted in base-metal type deposits with lead, zinc, copper, and some silver and gold accompanied by vein quartz and carbonate gangue. In some deposits finely divided uraninite occurs as a second stage introduction along fractures and shears within and adjacent to the base-metal veins.

Younger than the base-metal veins and presently more productive of uranium is the siliceous reef type of deposit characterized by an abundance of chalcedonic silica in the form of pods and stringers. Structures of this type have also been found to carry some sulphides of lead and silver. The Free Enterprise mine, a typical reef deposit, contains small amounts of rich ruby silver ore (pyrargyrite). Uranium occurs within the siliceous reefs and as disseminations in the adjacent wall rock chiefly in the form of secondary minerals such as autunite, meta-torbernite, and gummite in the oxidized zone. However, pitchblende has been found near the surface at the W. Wilson mine. Recurrent movement along the reefs is evidenced by widespread brecciation and recementing of the reefs. Commercial uranium mineralization has not been found at depths much beyond 100 feet in the siliceous reef type deposits. Very little is known about possible extensions in depth of the uranium mineralization associated with base-metal veins because mines with this type of material on their waste dumps are generally inaccessible. Outcrops and near-surface exposures of these veins are generally lacking in uranium. Radioactivity is found principally in material which was derived from the deeper mine workings.

## DIAMOND DRILLING PROJECT

### Areas Drilled and General Results

The diamond drilling program was planned to determine the character and extent of uranium mineralization beneath surface outcrops and shallow workings.

Both the base-metal type and the siliceous vein type of mineral deposit, where accompanied by uranium mineralization, were explored by drilling in eight general areas.

Diamond drilling was carried on in Secs. 8, 17, and 18, T. 8 N., R. 3 W.; in Sec. 25, T. 8 N., R. 5 W.; in Secs. 20, 35, and 36, T. 7 N., R. 5 W.; in Sec. 7, T. 5 N., R. 4 W.; and in Sec. 1, T. 8 N., R. 4 W.

### Base-Metal Type Deposits

#### A. Gray Eagle-Comet shear zone (No. 4, fig. 1)

This structure is situated about four miles northeast of Basin, Montana, and has been worked extensively in the past for lead, zinc, silver, gold, and copper. The major mines are the Gray Eagle mine and the Comet mine, situated about 1.5 miles apart along a mineralized shear zone over five miles in length. The wall rock is dominantly altered quartz monzonite with subordinate altered alaskite and dacite. Uranium-bearing vein material has been found on the dumps of both mines and on the dumps of smaller workings between them, as at the Silver Hill mine. Information from those who at one time worked in either of the mines as to where the pitchblende-bearing rock on the dumps might have been derived furnished the principal basis for locating some of the drill holes. Reference to old stope records and underground maps enabled the holes to be directed so as to avoid penetrating the workings.

A total of nine drill holes was completed at various points between the Gray Eagle and Comet mines. At the Gray Eagle mine, the holes were designed to intersect the vein between the 400-foot level and the 600-foot level. Holes at the Comet mine passed 20 or 30 feet below the 300 level on both the north and south splits of the vein.

Only two of the nine drill holes showed anomalous radioactivity and they indicated no more than weak uranium mineralization. Gaining access to the workings might be the more feasible method of furthering the search.

#### B. Lone Eagle mine (No. 1, fig. 1)

The Lone Eagle mine is located approximately 12 miles west of Clancy on Quartz Creek. The deposit is a base-metal type vein in altered quartz monzonite and aplite. The veins consist

essentially of quartz and pyrite with some galena, sphalerite, and chalcopyrite. Finely divided uraninite is found in the black silica veins and along slickensided fractures. Limited production was made from the mine late in 1953.

Three holes were drilled, but no radioactive vein material was encountered.

C. Nickelodeon Claim (No. 5, fig. 1)

Radioactivity, weak though extensive, and an unusual mineralogic assemblage prompted the drilling of two holes at the Nickelodeon claim, located about 3.5 miles south of Boulder. The vein is siliceous and contains much quartz and chrysocolla as well as minor quantities of tenorite, chalcopyrite, molybdenite, powellite, and scheelite. Unidentified platy yellow-green crystals coating secondary copper minerals, especially chrysocolla, are the sources of radioactivity. Two holes, drilled to intersect the vein 40 or 50 feet below the surface, encountered some secondary copper, but no appreciable radioactivity was found.

D. Uncle Sam Mine (No. 7, fig. 1)

The Uncle Sam mine is located about five miles north of Basin. A sample from a narrow black siliceous seam in the mine assayed approximately 0.1 percent  $U_3O_8$ . Two 200-foot vertical holes were drilled. Only slight radioactivity was exhibited where one of these holes crossed the vein.

Siliceous Reef Type Deposits

A. President Group (No. 3, fig. 1)

The bulk of the diamond drilling was carried on in the Clancy area. The President group of claims contains the most widespread uranium showings in the batholith. Although radioactivity is extensive, the uranium content is generally below commercial grade.

Exceptions are the W. Wilson deposit and possibly the occurrences on the G. Washington claim. Thirty-seven holes were drilled on the President group of claims, of which twenty were mineralized and seventeen were unmineralized. In all cases the holes explored the reefs from 25 to 50 feet below their surface outcrops. The results of drilling indicate that in most instances small isolated zones of uranium minerals of the outcrop do not persist even to moderate depths.

The uranium mineralization found by drilling on the east end of the G. Washington claim could lead to the opening of a new deposit if further work shows the presence of slightly better grade material.

B. Redstone-Atomizer Claims (No. 2, fig. 1)

Three holes were drilled in two moderately radioactive reefs located about four miles west of Clancy. None encountered more than weak radioactivity.

C. Red Rock Claim (No. 6, fig. 1)

Exposed along the main highway two miles west of Basin is a very prominent dike-like outcrop conspicuously dark red. On the flanks of the structure are steep talus slopes on which several highly radioactive fragments of rock float have been found. The reef exhibits radioactivity along steep slickensided surfaces roughly paralleling its strike. In no instances do these concentrations indicate more than thin coatings of low-grade uranium content at the surface. A drill hole penetrating 240 feet into the reef, intersected only one narrow zone that exhibited anomalous radioactivity, and that was below ore grade.

D. Mooney Claim (No. 8, fig. 1)

This claim, located four miles west of Butte, is a siliceous vein deposit. Mineralogic and structural evidence plus several encouraging assays of samples taken at the surface indicated mineralization warranting exploration at depth. One of three diamond drill holes encountered ore at two intervals. The best material assayed 0.32 percent  $U_3O_8$ .

over a width of 0.5 feet. This deposit warrants further exploration preferably by underground excavation.

### Drilling Operations

A total of 9,807.5 feet of core and non-core drilling was performed. Core recovery for the entire program was 29 percent. The low recovery was due to the badly weathered condition of much of the rock drilled.

### Radiometric Logging

Drill holes were probed to obtain a record of the radioactivity. Probe readings were generally taken at five-foot intervals until an anomalous zone was encountered, at which time the interval was shortened to one foot.

### Sampling Procedure

Samples of core for assay were taken from the zone of highest radioactivity; selection of the samples was based on both the probe readings and examination of the core.

In addition, the entire core from the hole was sampled to obtain a representative record of the rock penetrated.

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